removal of interfering amino-acids by stripping require different approaches.

Dr. C. H. Lea gave the final paper of this session, and of the first day of the symposium; he considered the role of amino-acids in the deterioration of food. He explained how a reaction between amino-acids and reducing sugars is responsible for deteriorative changes in flavour, colour, solubility and other properties in a wide variety of foodstuffs, and he reviewed the effect of humidity and temperature on these changes. He reported that reaction occurs with various amino-acid side-chains, including arginine, histidine, tyrosine and methionine, but that the combination would seem to involve something more than N-glycoside formation.

The morning session of September 30 was devoted to only two papers. The opening paper, by Dr. C. Ockrent and colleagues, dealt with the manufacture of amino-acids. Having reviewed the many uses of amino-acids, Dr. Ockrent explained that the optically active L-isomers are obtained commercially by separating them from the acid or enzymic hydrolysate of proteins, while the racemic DL-forms are manufactured synthetically. Examples were given of the separation of individual optically active amino-acids involving the use respectively of flavianic acid, picric acid and copper carbonate, and then Dr. Ockrent concentrated upon methods of synthesis. He discussed, with the aid of slides showing each step of the reactions, a series of commercially applicable methods of synthesis and a few methods mainly of academic interest.

This paper was followed by one by Dr. S. M. Partridge upon the use of displacement chromatography as a preparative method for amino-acids. Dr. Partridge described the use of columns of synthetic resinous ion exchangers for the separation of amino-acid mixtures, and explained how fractionation can be accomplished by displacement from a cation-exchange resin with a strong base. He described with the aid of slides an apparatus for the automatic collection of fractions from a displacement experiment, and showed how the purity of each collected fraction can be determined by paper chromatography.

The first of the two papers presented in the afternoon of September 30, which was by Dr. G. M. Dyson and Mr. E. M. Bavin, was concerned with the manufacture of protein hydrolysates. Dr. Dyson first discussed the consideration which decides the choice of protein material, and then explained that the main problems associated with large-scale manufacture are the elimination of pyrogens, the elimination of pressor and depressor substances, adequate hydrolysis of the protein and prevention of tyrosine deposition. He explained the various factors which influence these problems, and the steps taken to ensure that they are adequately dealt with. Dr. Dyson then gave a detailed description of the plant and process employed in large-scale production of protein hydrolysates, and discussed the rigorous control tests to which they are subjected.

Dr. Dyson's paper was followed by one from Dr. H. G. Rees upon the application of amino-acids and protein hydrolysates in the food industry. In this paper the methods available for the preparation of hydrolysed products for the flavouring of foods were considered. Dr. Rees then dealt more specifically with the use of monosodium glutamate as a food adjunct and discussed the history of this product and modern methods of manufacture.

The final session of the symposium was devoted to an address by Dr. D. P. Cuthbertson on amino-acids and protein hydrolysates in human and animal nutrition. Dr. Cuthbertson discussed in some detail the metabolism of proteins and amino-acids and then gave consideration to protein requirements in health and convalescence, protein insufficiency and the effects of trauma and infection. He stressed that dietary surveys conducted in temperate regions indicate that, at all ages from one year onwards and at all energy-levels, the protein intake expressed as a percentage of total calories is reasonably constant at 11–14 per cent. In a following section of his paper, Dr. Cuthbertson discussed the use of protein hydrolysates by intravenous injection and by tube into the alimentary canal, and summed up by saying that there is no solid evidence that there is any special value to be derived from such procedures. Dr. Cuthbertson also mentioned the subject of infusing sufficient protein (and energy) by intravenous injection, and suggested that the necessary indications for parenteral feeding are inability to ingest, digest or absorb adequate quantities of food over such a period of time as would jeopardize convalescence or even the chance of survival.

EFFECT OF LOW FAT INTAKES AND OF CRUDE FIBRE ON THE ABSORPTION OF FAT

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IT is well known that fat is well absorbed by man when consumed in amounts of 50–150 gm. per day. Under these conditions, the apparent absorption of fat $\left(\frac{I - F}{I} \times 100\right.$, where I is intake of fat and F the amount excreted in the fæces) is more than 90 per cent, less than this proportion being considered pathological. When the intake of fat is relatively low, however, the apparent percentage absorption is greatly reduced (58–62 per cent)[1,2]. The purpose of this communication is to provide evidence that the fat which is excreted in the fæces, and which is assumed to be unabsorbed fat in calculating the apparent absorption, is mainly of non-dietary origin, and that the true absorption of fat is not necessarily lower when the intake of fat is reduced. The evidence, which is based on the study of diets of different fat and crude fibre contents, also indicates that the additional amount of fat which is excreted in the fæces when the fibre content of a diet is greatly increased[3] is not unabsorbed fat, but is probably wholly of endogenous origin.

Balance observations were carried out on a healthy European male subject of thirty-five years of age, over a period of 124 consecutive days. During this period the intake of fat was maintained at four different levels, ranging from 61 down to 3 gm. per day; the fibre intake was controlled to yield stools of different weight, the normal stool averaging 30–35 gm. dry fæces per day, the moderately large 40–45 gm., and the very large 60–70 gm. Each successive level of fat and fibre intake was given until the average amount of fæcal fat excreted daily remained

Table 1

Normal fibre intake period (30–35 gm. dry fæces daily)			Moderately large fibre intake period (40–45 gm. dry fæces daily)			Very large fibre intake period (60–70 gm. dry fæces daily)		
Fat intake (gm. daily)	Fat excretion (gm. daily)	Apparent % absorption	Fat intake (gm. daily)	Fat excretion (gm. daily)	Apparent % absorption	Fat intake (gm. daily)	Fat excretion (gm. daily)	Apparent % absorption
60·1	3·25	94·6	60·5	3·35	94·5	61·0	3·45	94·3
22·5	3·1	86·2				21·9	3·25	85·1
12·4	2·6	79·1				12·0	2·95	75·4
3·3	2·4	27·3	3·2	2·55	20·2	3·5	2·85	18·6

The term 'fat' includes the free fatty acids present together with those derived from the glycerol esters and soaps; the determinations were carried out using the method of van de Kamer[4].

constant; these periods ranged from seven to twenty-one days. It is important to emphasize that the diets were neither unusual nor synthetic, but were composed throughout of foodstuffs in common use. The results obtained are summarized in Table 1.

For the sake of brevity the above results and further experimental results are discussed under the following headings:

(1) *Effect of changes of fat intake on the excretion of fæcal fat.* Reducing the fat intake below 22 gm. per day caused a slight reduction in the amount of fæcal fat excreted. On the other hand, altering the intake from about 60 gm. to 22 gm. a day had practically no effect on the amount excreted; a similar conclusion has been reached by Annegers *et al.*[5], who found that, under their experimental conditions, with fat intakes of 93–168 gm. per day, the fæcal fat excretion was independent of dietary fat intake.

(2) *Apparent absorption of fat at low fat intakes.* The apparent absorption of fat decreased with decreasing intake, a finding which also appears to apply to protein[6]. In this study, almost all the individual fats consumed are known to be well absorbed normally. Unless, therefore, fat is less well absorbed with decreasing intake, a phenomenon unknown for any other nutrient so far as I am aware, the above results can only be explained on the basis that a high proportion of fæcal fat is of intestinal origin.

(3) *Effect of crude fibre on the absorption of fat.* When a large increase was made in the crude fibre content of the equal fat diets, the amount of fæcal fat excreted detectably increased. In the investigation of Macrae *et al.*[3], this increase was much more pronounced, for under somewhat similar dietetic conditions the average excretion of fæcal fat (ether soluble) increased from 2·7 to 4·7 gm. a day. The question arises as to whether the *additional* fæcal fat is unabsorbed fat or is of non-dietary origin. Although the apparent percentage absorption of fat was slightly reduced by the high fibre diet, such a diet does not appear to reduce the true absorption of nitrogen[6]. Furthermore, although the ingestion of fibre usually shortens the time of passage of material through the digestive tract, in an investigation on diarrhœic patients[7] the apparent absorption of fat was reported to have been excellent. These considerations suggest that the additional fæcal fat is perhaps wholly of non-dietary origin; and that the intake of fibre, when high, controls the amount of this fat excreted, just as it controls the excretion of non-dietary nitrogen in the fæces[6]. The present investigation supports this view, in that the capacity of the high-fibre diet to raise the fæcal fat excretion is just as marked at low intakes, when the unabsorbed portion would be expected to be small, as it is at higher intakes.

While this issue of whether the additional fat be composed of unabsorbed or of intestinal fat may seem somewhat academic, it has a bearing on communities, such as the South African Bantu, whose customary diet, mainly of high-extraction maize products and beans, is high in fibre yet low in fat. This may be appreciated from Table 2, which provides data on the fat metabolism of two healthy young Bantu male subjects, and of a young European male who consumed exclusively as much as possible of the Bantu diet for ten days.

The unusually high amounts of fæcal fat excreted daily, particularly with the Bantu subjects, can scarcely be attributed to the types of fat consumed, since the fats of maize and most legumes have been reported to be highly digestible[8,9,2]. Nor can they be ascribed to the laxative effect of the fibre intake, for when 50 gm. butter was added to the diet of the European, no increase in fæcal fat excretion was observed, showing that optimum conditions for fat absorption prevailed. It would seem reasonable to conclude that the bulk or perhaps the whole of this fæcal fat is of non-dietary origin.

Recently, McCance and associate workers[6,10] fed humans with diets composed almost exclusively of wheat and oats—diets very rich in fibre, which led to the voiding of enormous stools. The average amounts of fæcal fat excreted daily were found to be very high, and were attributed to the low digestibility of the cereal fats, which were reckoned as 58 and 68 per cent respectively. Since much the same phenomenon occurred with the two Bantu subjects, with their maize and beans diet, the fats of which are known to be highly digestible, the low apparent absorptions found by these workers would seem to be more readily explicable on the lines suggested above. An additional argument against accepting that wheat fat is poorly digested is found in the metabolism studies of Macrae *et al.*[3]; when their subjects' basal diet, containing 43 gm. fat (mainly margarine), was supplemented with white bread containing 13 gm. wheat fat, the total daily fæcal fat excretion amounted to only 2·7 gm.; a figure of 5–6 gm. would have been expected on the basis of the above workers' theory.

As to the source of these large amounts of non-dietary fat excreted, information is meagre. The fat may be derived from (1) intestinal secretions, pro-

Table 2

Subjects	Period of observation	Av. intake crude fibre (gm. daily)	Av. intake fat (gm. daily)	Av. weight dry fæces (gm. daily)	Av. weight fæcal fat (gm. daily)	Av. apparent % absorption
2 Bantu (average figures)	21 days	15·5	25·8	109	13·2	48·8
1 European	10 days	11·5	16·6	54	7·1	57·3

Fat data corrected for minute amounts of fat contained in incompletely chewed food recovered from the fæces.

duced perhaps by excessive peristalsis due to the passage of the large amount of fæcal matter; (2) fatty acids produced by bacterial action on cellulose; or (3) bacterial synthesis. The fat itself is largely 'true' fat, for McCance[6] found little unsaponifiable matter present; moreover, I have found fairly close agreement between the fat determination by the van de Kamer and ether extraction Soxhlet methods, indicating the proportion of sterols, phosphatides, etc., present, to be very low.

(4) *Differences in fæcal fat excretion shown by humans on a standard diet.* From Table 1 it will be observed that the long-term subject, in the normal fibre intake and 60 gm. fat intake period, excreted 3·25 gm. fat daily. On returning to this diet, at the end of the investigation, it was found that the fat excretion remained steady at 2·8 gm. The same subject showed a 35 per cent change in fat excretion in an interval of four years when consuming the same test diet. This shows that changes in excretion do occur, although the assumption that the amount of fæcal fat excreted remains constant under ordinary dietetic conditions[5] may well be true for short periods. Sperry[11] found that the excretion of intestinal fat on a fat-free diet varied from dog to dog, and also in the same dog. It is therefore suggested that the wide differences in fæcal fat excretion found among humans on a standard diet[5,12] are due to differences in the amount of non-dietary fat excreted, rather than to differences in the capacity to absorb food fat. Of the non-dietary factors influencing the amount of intestinal fat excreted, little is known, though the work of Shapiro *et al.*[13], using labelled fat, suggests that alterations in the flow of bile may be of some significance.

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NUFFIELD FOUNDATION

PROSPECT AND RETROSPECT

THE fourth report of the trustees of the Nuffield Foundation* marks the end of the first planned period of the Foundation's activities. That period covers six years, of which the first (1943–44) was devoted principally to devising the programme to be followed in the next five. During these six years the Foundation has allocated grants of £2,124,175 from a total income of £2,712,838, divided among five main fields: £591,397 for the medical sciences; £289,750 for the natural sciences; £172,750 for the social sciences; £464,628 for fellowships and scholarships; £545,770 for the care of old people, while £59,880 went for miscellaneous projects outside the main programme. The present report is of exceptional interest not only for its appraisal of every major grant made during the period and the setting out of the principles of policy that have guided the trustees in their choice of projects, but also for the indication of their aims during the next quinquennium.

* Nuffield Foundation. Report of the Trustees for the Year ending 31 March, 1949. Pp. 128. (London: Nuffield Foundation, 12 Mecklenburgh Square.)

One of the chief objectives is, indeed, to promote not only the better investigation of problems but also the better integration of divergent specialized studies. Briefly, the policy in the medical sciences has been to promote the proper understanding, definition and maintenance, with the principal exception of rheumatism, rather than to seek cures for established diseases; in the natural sciences, to increase the resources available to man by fundamental research in physics; in the social sciences, to assist the disinterested study of human society and of men in society; in fellowships, to train promising undergraduates for teaching and research in subjects related to the Foundation's special interests and to develop a traffic of senior students and eminent men within the Commonwealth; in the care of old people, to survey and make known the needs of our increasingly elderly population and to create means to meet those needs. In furthering research and education in the medical, natural and social sciences, the Foundation has sought to select and support projects at the growing-points of each of these groups, with the motive of advancing knowledge particularly in those fields which seemed likely to yield some real improvement in the conditions of human existence. Mainly fundamental research has been supported, and for the next quinquennium the Foundation hopes to devote most attention to the advancement of biological and sociological studies which may contribute to the promotion of human health and welfare. In the field of biology, the Foundation will particularly welcome opportunities of supporting such studies as may increase our knowledge of the normal mechanisms of growth, differentiation and self-maintenance of living things. In the social sciences it is specially interested in bringing the non-economic studies—such as social anthropology or sociology in the narrow technical sense—up to the level of the more developed subjects like economics, and in increasing the integration of the various specialized subjects. In both fields the Foundation is prepared to support work aiming at the extension and application of known, and the search for new, aids to investigation.

Schemes likely to increase the number of able research workers in these fields of study or which would free existing research workers from unduly hampering and distracting commitments will also be considered, and the Foundation will try to assemble groups of experts in various subjects who are prepared to work together on the elucidation, by existing knowledge, of practical problems of far-reaching importance. Schemes of training fellowships and other awards will be continued, and the Foundation, through the National Corporation for the Care of Old People, will continue to contribute to their better care and the better satisfaction of their needs within the community. The Oliver Bird Fund will be devoted to fundamental research into the cause and nature of the disease-process of chronic rheumatism, and to an attempt under scientifically controlled conditions to assess the various known methods of alleviation.